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GEOPHYSICAL ABSTRACTS

NO. VII

BY

FREDERICK W. LEE

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

GEOPHYSICAL ABSTRACTS[1]

No. 7

Compiled by Frederick W. Lee[2]

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1. GRAVITATIONAL METHODS

THE COMPUTATIONS OF GRAVITATIONAL EFFECTS DUE TO IRREGULAR MASS DISTRIBUTIONS

By E. Lancaster Jones

Monthly Notices of the Royal Astronomical Society, Geophysical
Supplement, vol. 2, No. 3, May, 1929, pp. 121-140.

The X component of the gradient due to a small prism parallel to the X axes is a simple function of its depth, cross section, and $\left(\frac{1}{r_1^3} - \frac{1}{r_2^3}\right)$ where r is the diagonal radial distance of the end of the prism from the origin. The value of $\frac{1}{r^3}$ can be determined graphically by a very simple device. By the use of contours and horizontal parallels on the map, any irregular body can be split up into a series of such prisms of known cross section and depth. The values of $\frac{1}{r_1^3}$ and $\frac{1}{r_2^3}$ are read off graphically. The summation of the $\left[\text{summation of} \left(\frac{1}{r_1^3} - \frac{1}{r_2^3}\right) \text{for any depth times the proper constant of factors}\right]$ gives the total $\frac{\triangle^2 U}{\triangle x \triangle z}$ or $\left[\frac{\triangle^2 U}{\triangle y \, dy}, \frac{\triangle^2 U}{\triangle x \triangle z}, \left(\frac{\triangle^2 U}{\triangle y^2} - \frac{\triangle^2 U}{\triangle x^2}\right)\right]$. The The method is developed for horizontal and vertical prisms, for cylindrical coordinates, and for the computation of $\frac{\triangle^2 U}{\triangle z^2}$, $\frac{\triangle U}{\triangle x}$, $\frac{\triangle U}{\triangle y}$, and $\frac{\triangle U}{\triangle z}$.

This is a quick simple method of calculating the gravitation effects, where assumptions of symmetry may not be used. Most American geologist-geophysicists will not be able to follow the argument of the paper without the assistance of a mathematician. -- Donald C. Barton.

THE TORSION BALANCE IN THE DETERMINATION OF THE FIGURE OF THE EARTH

By Donald C. Barton

American Journal Science, vol, 18, 1929, pp. 149-154.

On account of the warping of the level surfaces and of the lines of the vertical, the Eötvös torsion balance can measure the horizontal gravity gradient and a quantity proportional to the difference of the radii of curvature of the level surfaces. The variation of gravity can be calculated from the gradient, and the form of the level surface and the variation of the deflection of the vertical can be calculated from the differential curvature for the area between two points, if absolute geodetic observations are available at those points. Determinations of Δg at Damon Mound by the torsion balance and pendulum methods do not check within 0.036 dyne, about 15 times the probable error of observation. In Oklahoma the values of Δg for four stations as determined give very much closer approximation to the theoretical values than the pendulum observations reduced by the isostatic Bouguer or free-air methods. The gradient due to the flattening of the earth calculated from 1,100 torsion balance observations was 7.4E against the theoretic value of 7.14E. Various positive anomalies of 0.030, 0.157, and 0.500 dynes have been mapped in Texas, Oklahoma, and New Mexico, and the most important contribution of the torsion balance to geodesy is the knowledge of the detailed variation of gravity over large areas and of the abundant presence of local anomalies of very large magnitude. -- Author's abstract.

TABLES OF TERRANE EFFECTS

By Donald C. Barton

Bulletin of the American Association of Petroleum Geologists,
vol. 13, No. 7, July, 1929, pp. 763-779.

Tables of terrane effects have been devised for use in routine commercial surveys with the torsion balance in areas of moderate relief. For that purpose they are a slight refinement and improvement over the graphical methods of calculating terrane effects, described by the writer, Haalck, and Heiland. The terrane is divided into

(a) Octants and zones of $5\sqrt[3]{10^n}$ radius, and into

(b) $22\frac{1}{2}^\circ$ sectors and zones of $5\sqrt[6]{10^n}$ radius.

Each zone is divided vertically into prisms, and this series of prisms is projected by the law of similar bodies in projection of one another into the other zones of the same octant or sector. The gradient and differential curvature produced by each of the prisms is calculated by the formula for a vertical concentric curvilinear prism in cylindrical coordinates. The effects are tabulated for elevations of 0 to 2 in the 5 to 11 zone (5 to 7.3), and the corresponding elevations in the 11 to 23, and 23 to 50 zones (7.3 to 10.8, 10.8 to 16.9, 15.9 to 23.2, 23.2 to 34.1, and 34.1 to 50 zones). A similar table is given by octants for the zone 0 to 2.3. A somewhat similar table is given for the effects produced by an infinite straight ditch or embankment. These tables, or preferably tables valid to infinite depth, can be used to calculate the effects of anomalous masses in the subsurface. -- Author's abstract.

ANONYMOUS EDITORIAL

The Mining Magazine, vol. 40, No. 6, June, 1929, p. 328.

A note states that "the gravity gradiometer designed by Capt. Shaw and Mr. E. Lancaster Jones ** has been used successfully and employed in surveys of the brown coal fields of Victoria, Australia." -- Donald C. Barton.

UEBER DIE FESTSTELLUNG VON VERWERFUNGEN MIT DER DREHWAAGE

(DETERMINATION OF FAULTS WITH THE TORSION BALANCE)

By H. Seblatnigg

"Braunkohle," vol. 23, 1929, pp. 1-5.

The torsion balance was used to determine the course and position of a shallow fault in the Borken Tertiary brown coal field in Germany. From widely spaced core holes, Buntsandstein was known to have been faulted up to within 15 meters of the surface. Four profiles were run with the torsion balance to determine the exact position of the fault. The torsion balance determination of the fault was checked by the results of subsequent drilling. -- Donald C. Barton.

DIE ENTWICKLUNG DER EÖTVÖSCHEN ORIGINALDREHWAGEN

(DEVELOPMENT OF EÖTVÖS' TORSION BALANCE)

By D. Pekar

Die Naturwissenschaften, vol. 51, Dec., 1928, pp. 1079-1088.

A detailed description of the development of the Eötvös torsion, the first model of which appeared under the name "Horizontal gravity variometer" as early as 1890, is given.

A series of photographic pictures of various models completes the article.

Pekar indicates the importance of the torsion balance in geophysical, seismical, geodetical, and geological investigations, as well as its practical application for ore prospecting.

Photographic registration of the data, according to Pekar, is not used in Hungary for the following reasons:

1. The instrument is affected by the heat of the lamp;
2. The keeping in order of lights and arrangements for automatic registration is often difficult;
3. Errors may arise owing to disarrangements in the registration device; they can be established only after the development of the film.
4. The development of the films in the field is difficult, especially during bad weather.
5. Numerical data obtained by visual observation may be utilized immediately, while the photographic data must be calculated.

In the opinion of the author, all these disadvantages can not be counterbalanced by the sole advantage of photographic registration--that of convenience. -- W. Ayvazoglou.

A GRAVITY VARIOMETER MADE OF VITREOUS SILICA

By Chuji Tsuboi

Proceedings of the Imperial Academy, Tokyo, vol. 4, No. 6, 1928, pp. 300-302.

Tsuboi describes the result of an attempt to construct a gravity variometer from vitreous silica, as by using this material the weight of the instruments may be reduced considerably. The following favorable physical properties of vitreous silica are mentioned especially: The material is almost entirely free from elastic hysteresis, and its thermal expansion coefficient is extremely small; the material can be drawn into an extremely fine fibre with a radius of 5 microns. As the sensitivity of the variometer is inversely proportional to the fourth power of the radius of the suspension fibre, the author considers this circumstance alone sufficient for preferring the use of this material for the present purpose.

A detailed description of the instrument is given; its weight with necessary accessories scarcely surpasses 8 kilograms. Preliminary measurements of the second space derivatives of the gravitational potential with the new balance gave satisfactory results. Two readings corresponding to the two settings of the balance in the same azimuth but with different previous settings coincide with each other satisfactorily. According to the author this is partly due to the fact that the suspension fibre is directly fused on the rod, avoiding any kind of binding material. -- W. Ayvazoglou.

2. MAGNETIC METHODS

A NEW MAGNETOMETER

Anonymous

The Mining Magazine, vol. 41, No. 1, July, 1929, pp. 37-39.

The new magnetometer manufactured by the Cambridge Instrument Co. of England is essentially a sine galvanometer adapted to the measurement of the relative intensity of the horizontal component of the earth's magnetic field. A known current accurately measured and flowing through the coil is used to cause a deflection of a floating magnet. The magnetometer is designed to measure field intensities ranging from 0.16 to 0.19 c. g. s. with an accuracy of one part in 20,000. A complete determination can be made in 10 minutes. -- Donald C. Barton.

MAGNETIC OBSERVATIONS ON THE SWYNNERTON DYKE

By A. F. Hallimond

The Mining Magazine (London), vol. 41, No. 1, July, 1929, pp. 16-22.

A series of 12 profiles was run with a Schmidt-Lloyd vertical variometer across the Swynnerton Dyke in North Straffordshire, England, a nearly vertical nepheline basanite dyke rather rich in iron ores and intruded into Keuper marls. The northern profiles were run across outcrops of the dyke. The profiles G to P mapped the hidden southern extension of the dyke. The anomaly ranged from nearly 1,200 gamma on the northernmost profiles to 15 to 50 gamma on the southernmost two profiles. Where the dyke is very wide (200 feet) the marginal portions show peaks of maxima; specimens obtainable along profile B show the central portion of the dyke to be much poorer in iron ores than the marginal portions. The profiles show that the width of the dyke decreases to about 15 feet on profile E. Yet further south the dyke is represented by three small dykes. On one profile across an exposed portion of a 4-foot dyke, observations were made with the magnetometer at elevations both of 2 feet 8 inches, and 4 feet above the ground. Although no such statement is made by the author, the results indicate that the center of effect is essentially at the surface and therefore suggest that the dyke is magnetized vertically with the upper pole practically at the surface, for the ratios of the intensities measured at the 2-2/3-foot and 4-foot elevations are 1.4:1 over the dyke and 1:06 at a distance of 15 feet away from the dyke. -- Donald C. Barton.

THE HISTORY OF MAGNETIC PROSPECTING FOR ORE

By Hans Lundberg

The Mining Magazine (London), vol. 40, No. 2, August, 1929, pp. 73-78.

Magnetic prospecting for magnetic ores has been in successful use in Sweden since early in the 17th century and in New York and New Jersey since the 18th century. The miner's (dip) compass dates from the 18th century. A great advance came with Thalen's contributions to the theory of magnetic prospecting and with Thalen and Tiberg's invention of the magnetometer and inclinator in the early 80's of the 19th century.

Experimental work with the electric methods dates from Fox's work in England in 1830. Contributions were made by Reich of Germany in 1844, Barus in Nevada in 1880, and by Williams of England and Daft of America in the late 1890's. The first ore body was discovered by Muenster of Norway in 1907. Much experimental work was done in Sweden in 1907, and beginning with 1912. Schlumberger perfected his natural earth current method in 1912. The equipotential method was introduced by Bergstrom in 1913. The liner electrode method was perfected by Lundberg and Nathurst in 1918. The first experimental work with the electromagnetic methods was done by Lowy and Leimbach in Germany in 1910-1911, and by Conklin in America in 1917. The first ore body was discovered by electro-magnetic methods by Sundberg in Sweden in 1921. The first discovery of ore in America by electrical prospecting was made by Swedish engineers in 1924. — Donald C. Barton.

MAGNETOMETER SURVEY OF LOUISIANA

By L. Sparagen

The Oil and Gas Journal, vol. 27, No. 46, April 4, 1929,
pp. 105 and 110; vol. 27, No. 48, April 18, 1929, pp. 85 and 96.

The survey is based on the U. S. Coast and Geodetic Survey observations, which with few exceptions, were made only at the parish (county) seats. The vertical intensity is contoured with isogams of 100 gammas interval both for:

(a) The observed vertical intensity, and

(b) The latter corrected for the regional variation.

A vague reflection of some of the major structural features can be seen in some of the magnetic anomalies; the Sabine and Monroe uplifts show positive anomalies and the intervening geosyncline shows a negative anomaly; an east-west positive anomaly corresponds with the west half of the Sulphur-Lockport-Jennings salt-dome line. But on the other hand, the Many area shows as big a positive anomaly as the Sabine uplift and the area southeast of Lafayette and Baton Rouge, and the indications from the magnetic anomalies are contrary to the geology. The stations are so widely scattered that such studies are of very slight practical value to the experienced geophysicist and are dangerous in the hands of a layman. -- Donald C. Barton.

MISSISSIPPI MAGNETOMETER READINGS

By L. Sparagen

The Oil and Gas Journal, vol. 27, No. 52, May 16, 1929, pp. 39 and
198; vol. 28, No. 3, June 6, 1929, p. 48; vol. 28, No. 6,
June 27, 1929, pp. 101 and 178-182.

The study is based on the U. S. Coast and Geodetic Survey observations, most of which were made only at the county seats. Isogam maps are given:

(a) For the observed values of the vertical intensity, and

(b) For the anomalous value of the vertical intensity obtained by applying a regional correction.

Profiles of the vertical intensity are drawn on several lines across the State. Although certain vague reflections of the major features of the subsurface structure can be seen in the magnetic results, the stations are so few and so far apart that studies of this type are of little service to the expert geophysicist and are dangerous in the hands of the layman. -- Donald C. Barton.

BEITRÄGE ZUR THEORIE DES MAGNETOMETERS VON TIBERG-THALEN

(CONTRIBUTIONS TO THE THEORY OF TIBERG-THALEN'S MAGNETOMETER)

By Viktor Theimer

Zeitschrift fuer Instrumentenkunde, vol. 7 and 8, July and August, 1929, pp. 342-356 and 386-395.

After a brief introduction dealing with the purpose of the instrument, Theimer describes its construction. The constituent parts of the Tiberg-Thalen-Dahlblom magnetometer are a compass with a strong magnetic needle and two arms provided with a millimeter graduation; the arms form a constant angle of 30°. The original Tiberg arm is removed to the prolongated zero-direction of the hour-circle and has a millimeter graduation of from 10 centimeters to 22 centimeters. The Dahlblom arm, which forms with the Tiberg arm a constant angle of 30°, has a millimeter graduation of from 10 centimeter to 44 centimeter; thus, it is twice as long as the Tiberg arm.

Both arms are provided with adjustable sliding carriages to which a short but very strong bar magnet can be fixed.

The bar magnet, fixed to one of the two sliding-carriages, forces the magnetic needle of the compass to decline at a certain angle from its original position of rest; from this angle, as well as from the adjusted distance of the center of the bar magnet from the point of rotation of the magnetic needle the horizontal intensity of the earth magnetic field for a certain point of observation can be determined.

In the present article Theimer describes the methods for observations and calculations in connection with this arrangement of the magnetometer. Detailed calculations, accompanied by pictures, for the measurements of horizontal and vertical intensities are given.

The last part of the article deals with the use of the Tiberg-Thalen magnetometer for the discovery of ore deposits; some special cases are examined. -- W. Ayvazoglou.

DIE MESSUNG DER HORIZONTAL UND DER VERTICALINTENSITÄT DES ERDMAGNETISCHEN FELDES MIT DEM MAGNETRON.

(MEASUREMENT OF THE HORIZONTAL AND VERTICAL INTENSITY OF THE EARTH'S MAGNETIC FIELD WITH A MAGNETRON)

By M. Rössiger

Zeitschrift fuer Instrumentenkunde, vol. 3, March, 1929, pp. 105-113;
Zeitschrift fuer Geophysik, 1928, pp. 371-372.

The possibility of measuring the earth's magnetic field by means of a "magnetron" was noticed in 1923 (A. Hull). In the two articles mentioned above the author describes the arrangement of the magnetron, as well as its use. The magnetron is an electronic tube provided with two electrodes one of which is a straight filament serving as a source of electrons, and the other a cylindrical plate along the axis of the filament.

The filament is the cathode and the plate is the anode of the tube. The electrons which leave the filament are diverted by the magnetic field directed parallel to the filament into circular courses. The anode current is represented as a function of the magnetic strength of field. The current between the filament and the plate can be stopped by applying a magnetic field parallel to the filament. If the applied magnetic field is below a certain critical value it has little influence upon the current; at the critical value the current decreases very rapidly, and above it the current is zero. In the transition region the magnetron is a sensitive indicator of changes in the magnetic field. A change of field of 10 γ corresponds to the change of the anode current of 2 by 10^{-7} ampere. In order to utilize this sensitiveness the great influence of the heating current must be reduced. This effect is obtained by conducting the heating current through a coil coaxial with the filament. The number of turns of the coil is calculated so that the increase of the anode current caused by the increase of the heating current is counterbalanced by the increased magnetic field of the coil. The magnetron and the coil form the indicator. The indicator is secured rigidly inside of a pair of Helmholtz coils, and the whole system can be turned about a horizontal and vertical axis.

For taking measurements of the horizontal intensity the filament is brought into a horizontal position, the apparatus rotated about a vertical axis, and the plate-current read. Maximum and minimum intensities occur when the filament lies in the magnetic meridian.

Having fixed the filament in the meridian plane, the plate-current is read. The apparatus is swung through 180° about a horizontal axis, and the plate-current is brought back to its old value by sending a current through the Helmholtz coils. The compensating field of the Helmholtz coils is then twice the horizontal intensity.

The vertical component is measured similarly.

In order to eliminate the error in the adjustment of the tube the measurements are repeated after the apparatus has been turned 180° about the vertical axis.

The accuracy of the measurements is about 40 γ. The weight of apparatus is 40 kilograms, including the storage batteries. -- W. Ayvazoglou.

DISTRIBUTION - COEFFICIENTS FOR VERTICAL-INTENSITY MAGNETIC VARIOMETERS

By H. E. McComb

Terrestrial Magnetism, vol. 34, No. 1, March, 1929, pp. 59-61.

Scale values were determined in the usual manner by means of a small deflector at short distances and with the deflection bar set for various azimuths. These were referred to the values obtained with a large deflector at a great distance as standard, and from the resulting differences the distribution factors were computed. -- Author's abstract.

VARIOMETER SCALE-VALUE DETERMINATIONS WITH A LARGE DEFLECTOR

By A. K. Ludy

Terrestrial Magnetism, vol. 34, No. 1, March, 1929, pp. 63-66.

Vertical and horizontal-intensity variometer scale-values were determined by the usual method of using a small deflector at short distances and a large deflector at large distances. The results indicate that the latter method has several advantages and is to be preferred. -- Author's abstract.

METHOD IN OSCILLATIONS

By W. N. McFarland

Terrestrial Magnetism, vol. 34, No. 1, March, 1929, pp. 67-72.

The aim of this paper is to develop the best arrangement of the oscillation-observations of the measurement of horizontal intensity by considering the relative precisions obtained from varying the length of the series and the method of computation.

The variation of precision in the final mean value with arrangement of the observational and computational work is shown by a figure, and the formula is stated for the propagation of this observational error into the computed value of the horizontal intensity. -- Author's abstract.

ON CERTAIN SOURCES OF ERROR IN DETERMINATIONS OF MAGNETIC DECLINATION

By Gustaf S. Ljungdahl

Terrestrial Magnetism, vol. 34, No. 1, March, 1929, pp. 73-76.

In a magnetometer fitted with an optical collimating-system attached to the magnet a possibility exists of corrections, which are due to defects in the lens. A perfect magnetometer ought not have any corrections at all in determining declination. A criterion of noncorrection is given. Errors of observation may be diminished by pointing on more than one reticle in the field of view of the telescope. -- Author's abstract.

A MAGNETIC RESURVEY OF PART OF THE NORTHAMPTONSHIRE IRON FIELD

By W. H. Fordham

The Mining Magazine, London, vol. 39, No. 1, July, 1928, pp. 18-25.

The article contains a description of a new magnetometer for the measurement of the vertical component of the magnetic force, made by L. Oertling, Ltd., of London.

Results of a resurvey over a bed of the Northamptonshire iron field carried out with this instrument are given.

The new instrument is a sensitive design of the Thompson-Thalen magnetometer, the only essential difference being that a pair of vertical control magnets, with poles reversed, has been substituted for the single magnet.

By means of a balance weight the instrument is adjusted to read zero in a normal field. When observations are made in a disturbed field, the instrument reads high if the force is greater than the normal and low if less, and is brought back to read zero by raising or lowering one or the other of the vertical magnets.

From the distance through which the magnet is moved the change in force is calculated.

The theory of the instrument is described, and details of it are given, accompanied by a view and diagram.

The resurvey of the Northamptonshire district was made in 1928 at 32 points marked on the plan. The new instrument described above was used for the observations.

A copy of the field book is given in a table; the results, which in general must be considered to be reliable, are plotted in a figure. -- W. Ayvazoglou.

MAGNETIC SURVEY IN THE REGION OF BABA-ZANAN

By A. Zaborovsky (In Russian)

Azerbeidjan Petroleum Industry, Baku, vol. 4, April, 1928, pp. 49-52.

A necessary condition for obtaining information by means of magnetic survey consists of the presence in the ground of materials possessing precise magnetic properties. The oil-bearing regions of the Apsheron peninsula (Caucasus), as well as the regions situated close to it, contain magnetite with all its properties, such as high magnetic susceptibility and capability of being magnetized under the influence of the inductive effect of the earth's magnetic field.

Although the amount of magnetite usually does not exceed 1 per cent, it is sufficient for calculating the approximate value of the magnetic field created by magnetite included in rocks 10 meters thick and at a depth of 100 meters; the maximum value of the magnetic tension will be of the order of 5 γ. The measurement of such a field by using modern instruments is possible. Based on these calculations a magnetic survey in the region of Baba-Zanan was started.

Magnetic observations were made on a series of stations situated along two lines parallel one to another. For the establishment of horizontal and vertical intensities local variometers were used.

The accuracy of measurement was estimated at $\pm 5\ \gamma$ for the horizontal intensity and $\pm 9\ \gamma$ for the vertical component of the magnetic field.

A map of the region and diagrams of magnetic curves are given. The results obtained were examined and have proved to be satisfactory.

The author concludes that the question of using magnetic methods as an aid in geological investigation of regions similar to that of Baba-Zanan must be solved in favor of these methods under the condition, of course, that the most sensitive instruments available at the present time are used. -- W. Ayvazoglou.

3. SEISMIC METHODS

FURTHER NOTE ON SEISMIC OBSERVATIONS WITH LONG PERIOD HORIZONTAL PENDULUMS

By Akitune Imamura

Proceedings of the Imperial Academy, Tokyo, vol. 4, No. 7, 1928, pp. 367-370.

The present paper is the result of observations made by Imamura, with special reference to large earthquakes of near origin, with a seismograph having a free vibration period of a length of 3.5 minutes.

The writer was especially interested in the observations of slow waves. Figures are given showing the reproduction of seismograms of the earthquake originating on May 27, 1928, and obtained with the 3-minute pendulums. The cause giving use to slow seismic motions.the writer is inclined to attribute to the large displacements of crustal blocks; that of the quick seismic motions, registrable by the ordinary seismograph, may be assigned to vibrations caused at the place of contact of two adjacent blocks in the course of their sliding, pressing, etc., against one another. -- W. Ayvazoglou.

NEW SEISMIC METHOD SAID TO PARALLEL CURRENT PRACTICE

By Donald C. Barton

Engineering and Mining Journal, vol. 128, No. 5, Aug. 3, 1929, p. 180.

This is a brief note calling attention to the fact that the "new" seismograph method described by R. Ambronn in "Modern Instruments for Seismic Prospecting," Engineering and Mining Journal, vol. 128, No. 3, July 30, 1929, pp. 93-99, is not new but parallels current American practice, and that Dr. Ambronn's paper totally ignores American practice of the past four years. -- Donald C. Barton.

MODERN INSTRUMENTS FOR SEISMIC PROSPECTING

By R. Ambronn

Engineering and Mining Journal, vol. 128, No. 3, July 20, 1929,
pp. 93-99, (Translated into English by E. U. Von Buelow.)

Dr. Ambronn announces a "new" type of seismograph which registers electrically the acceleration of the earth movement rather than the total movement registered by the mechanical seismographs. On account of the electrical registration, very high amplification is possible. Several receivers and the shot time-line are connected to a multiple unit recording galvanometer and record on a single film. Time can be measured to 0.001 second. A considerable discussion is given of the advantages of an electric seismograph registering acceleration compared to the disadvantages of the mechanical seismograph registering total movement.

The assertions are made by Ambronn that seismographs used to date are mechanical seismographs; that his new seismograph has much higher sensitivity than the seismographs in use; that the ordinary ground unrest is avoided; and that explosive charges of the order of only 20 to 100 grams of dynamite per kilometer are sufficient to give clear records.

This paper reflects the same stage of development through which the American seismic method passed four years ago. The general type of instrument and method which are proposed by Ambronn have been standard in America for four years. More electric seismographs, registering acceleration, are in use in America than any other type. That type of seismograph and the method proposed by the writer already have to their credit 12 salt domes definitely proved by drilling, and many more which have not yet been drilled. Several types of American electric seismographs have very much greater sensitivity than the "new" instrument, and possible amplification that they can use. Abundant ground unrest of sufficiently short period seriously to obscure the impact of the explosion waves is present and precludes the use of high sensitivity and amplification, although of course, as the author correctly states, the unrest with a period longer than a few tenths of a second does not seriously affect the acceleration type of instruments. It has been found in this country that the inexperienced introducers of a new type invariably stress the supersensitivity of his instrument and the smallness of the charge of dynamite required. As the controlling factor is the ground unrest and not the supersensitivity of the instrument, there is no reason to believe that the seismograph proposed by the author has any greater effective sensitivity or can use any lower charges of dynamite than the present American electric seismographs. According to the standards of American practice, many of the seismograms illustrating the paper show an attempt to use too much amplification and not enough dynamite and would be thrown out as having too much ground or instrumental unrest. -- Donald C. Barton.

A DEVICE FOR PREVENTING THE INSTABILITY OF HORIZONTAL SEISMOMETERS

By Kyoji Suyehiro

Proceedings of the Imperial Academy, Tokyo,
vol. 4, No. 10, Dec., 1928, pp. 597-599.

In one of his previous notes Suyehiro showed that a horizontal seismometer, using the Paschwitz pendulum, became unstable when it was subjected to a horizontal accelerating motion parallel to the central plane of the apparatus, and that consequently the record obtained by it was not trustworthy.

To avoid this the author constructed an apparatus, the description of which is given in the article. The apparatus consists of a pair of Paschwitz pendulums placed parallel to each other in opposite directions, with a proper distance between their central planes. In order to unite the pair and to make a closed kinematic chain out of them, the tops of the frames holding the weight are bridged by a coupler link over the center of gravity of each weight.

When such a duplex pendulum is subjected to an accelerating motion in the longitudinal direction, perpendicular to that motion which the apparatus is intended to register, the instability, if occurring, of one of the pair caused by this motion is compensated by the increased stability of the other.

The author compared the behavior of the single and duplex types, placing them upon a special experimental oscillating platform. The results of the tests show that whereas the single type, having the natural period of 4.0 seconds is set into a violent oscillation under the oscillation of the platform at a period of 1.9 seconds, the duplex type, having the same natural period, is only slightly affected by the same oscillation of the platform. Diagrams showing the results of the experiment are given. — W. Ayvazoglou.

4. ELECTRICAL METHODS

NEUERES ÜBER GEOELEKTRISCHE UNTERSUCHUNGSMETHODEN MIT WECHSELSTROM

(ON THE GEOELECTRIC METHODS OF PROSPECTING BY MEANS OF ALTERNATING CURRENT)

By Wilhelm Geyer

Helios, No. 23, June, 1929, pp. 221-226.

After the description of geoelectrical methods of prospecting, especially of the direct current method introduced by Schlumberger, Geyer compares this method with that in which alternating current is used. He mentions the advantages of the latter method and explains the proceedings of measurements.

A list of literature on electrical methods of prospecting is added. -- W. Ayvazoglou.

ELECTRICAL PROSPECTING OF ORE BODIES BASED UPON MEASUREMENT OF ALTERNATING MAGNETIC FIELDS (In Russian)

By V. Frederiks

Comité Géologique, Materiaux pour la géologie générale et
appliqué. No. 132, Leningrad, 1929, 137 pages.

The author gives the results of electrical prospecting, based upon measurement of alternating magnetic fields, performed in the U.S.S.R. during the last three years.

The book is divided into three parts:

Part I.

Chapter 1. Magnetic field produced by an alternating current directed to the ground or flowing through a cable.

Chapter 2. Methods of measuring the magnetic field.

Chapter 3. Coils with two axes of rotation

Chapter 4. Three-axial coils.

Chapter 5. Phase measurements and the method of two coils.

Chapter 6. Measuring of electromotive forces by means of lamp-voltmeters.

Part II: The normal magnetic field.

Chapter 7. The normal magnetic field.

Chapter 8. Observations made on the first normal field in Ushaki, near Leningrad; comparison of it with the theoretical normal field with cables arranged according to Sundberg.

Chapter 9. Observations made on the second normal field in the Ural with the same arrangement of the cables.

Chapter 10. Observations made on the third normal field in the Ural with the same arrangement of the cables.

Chapter 11. Observations made on a normal field with the arrangement of the cables according to Elböf.

Chapter 12. Observations made on a normal field by using closed loops.

Part III. Observations made on ore-bearing areas.

Chapter 13.	Observations made on the first ore-bearing area with the arrangement of the cables according to Sundberg.
Chapter 14.	Observations made on the second ore-bearing area with the same arrangement of the cables.
Chapter 15.	Observations made on the third ore-bearing area with the same arrangement of the cables.
Chapter 16.	Observations made on the third ore-bearing area with the arrangement of the cables according to Bursian.
Chapter 17.	Observations made on the same area with the arrangement of the cables according to Elböf.
Chapter 18.	Observations made on the San-Donato (Ural) ore-bearing area by using closed loops without grounding.
Chapter 19.	Conclusions.

The first part serves as an introduction in which certain properties of an alternating magnetic field produced by an electric alternating current, either directed to the ground or flowing through a cable, are described. Methods of measuring the magnetic field are pointed out and the designations of the different peculiar values explained. Coils with two and three axes of rotation, as well as the methods of handling them, are described. Lamp-voltmeters applied for measurements of electromotive forces were of swedish construction.

The second part deals with the so-called "normal" magnetic field. In some cases the data were calculated theoretically and the results of calculations were compared with the data obtained by observations.

The third part contains a description of observations made on several ore-bearing areas. The results obtained are shown in diagrams. The graphical method of interpretation was used in most cases.

The results of the observations are summarized by the author as follows:

1. The method of prospecting based on the measurement of the intensity of magnetic fields by means of cables disposed according to Sundberg, Bursian, or in the form of closed loops, made it possible to determine in all the cases examined the places and the depth at which the ore body is to be sought. The determination of the declination and of the dip of ore bodies occurring under conditions similar to those explored by means of the methods described above is, so far, difficult.

2. A similar method with Elböf's short cable provides the possibility of determination of the presence of the ore, but does not supply any exact indication regarding the extent and the location of the ore body, nor any indication concerning its depth.

It shows with great exactitude the direction of the strike of the country rock, and thus may adequately be applied for that determination. -- W. Ayvazoglou.

5. RADIOACTIVE METHODS

MESSUNGEN UEBER DAS KURZWELLIGE ENDE DER DURCHDRINGENDEN HÖHENSTRAHLUNG

(MEASUREMENTS ON THE LIMIT OF THE PENETRATING ALTITUDE OF SHORT-WAVE RADIATION)

By E. Regener

Die Naturwissenschaften, vol. 11, March, 1929, pp. 183-135.

Regener performed measurements of the altitude of penetration of radiation by lowering into Lake Constance, at a depth of about 340 meters, special self-registering apparatus, as this is the sole means to overcome the technical difficulties of this kind of measurements. A steel bomb with walls 1 centimeter thick and 39 liters in volume was used. The bomb was filled with carbonic acid at a pressure of 30 atmospheres.

The central electrode was provided with a unifilar electrometer of special construction. The return of the electrometer, which was charged at 600 volts, was registered by a photographic plate every hour. The registrations made at different depths are given in a figure which shows the decrease of ionization with the increase of depth.

Special arrangements were made to prevent any possible movement of the apparatus lowered into the water. Values of ionization at various depths are given in a table.

The length of the wave was calculated from the absorption coefficient. By using Compton's formula the length of the wave was equal to 4.6 by 10^{-13} centimeters; by using Dirac's formula, 2.74 by 10^{-13} centimeters, and by using Klein and Nishina's formula, 0.6 by 10^{-13} centimeters.

The purpose of hourly registrations performed in the course of two days consisted of obtaining mean values of ionization for different depths. At small depth variations of radiation were especially distinct. -- W. Ayvazoglou.

7. UNCLASSIFIED METHODS

GEOPHYSICAL METHODS OF PROSPECTING, PRINCIPLES, AND RECENT SUCCESSES

By C. A. Heiland

Quarterly of the Colorado School of Mines, vol. 24, No. 1,
March, 1929, 163 pp., 65 figs.

The purpose of the paper is not only to describe the fundamental principles of geophysical prospecting, but mainly to demonstrate the actual extent and recent successes of geophysical methods on this continent. The table of contents comprises the following headings: Introduction, significance of geophysical prospecting, possibilities and limitations; classifications of geophysical methods; gravity methods, magnetic methods, radioactive methods, geothermal measurements, seismic methods, electrical methods, underground geophysical prospecting; depth reached with geophysical methods, cost of geophysical work; statistical section, list of consulting geophysical companies and geophysicists and of manufacturers of geophysical instruments; statistical review of recent geophysical activities in United States, Mexico, and Canada; and list of counties in which geophysical work has been done.

This pamphlet contains a mine of information; much reference material is embodied in it, and the reviewer himself refers to it rather often. An elementary understanding of the various methods can be gotten from it by anyone who has a modest knowledge of physics, but the oil man and geologist may find the exposition of the various methods somewhat involved. It succeeds, however, in giving a most vivid picture of the magnitude and extent of geophysical prospecting in this country at present, although the picture of the success of the methods is painted a little overbrightly.

The following detailed criticism is pertinent within the fields with which the writer is especially familiar:

Page 7: The possibility of the location of petroleum directly by any gravity method, no matter how close to the surface, is doubted by the reviewer.

Pages 27, 28, and 29: The gravity minima at Orange and Welsh much more probably represent deep salt domes than by lows in the pre-Tertiary surface.

Boling has been a productive dome for several years.

The comments on Markham and Damon Mound are reversed.

Page 31: Boling, the richest known sulphur deposit in the world, is omited from the list of the sulphur domes.

No. E9 and E36, Gulf Sulphur and Big Hill-Matagorda are identical.

No. E47, Raccoon Bend should be classed under A, Presence of dome not yet proved.

Group II, "Gulf Coast salt domes discovered by torsion balance," includes one old known dome (Davis Hill). Two prospects which were never generally accepted as probably salt domes (Dickinson and Youngs Ranch), and others which are not generally accepted definitely as probable domes.

Page 32: Many of the domes listed are of doubtful probability, and No. A4 Ferguson (Clay Creek or Gay Hill) was discovered on the basis of surface geology, not by seismic work, although it was checked by the seismograph before it was drilled.

No. A5 Hankamer is a (now productive) dome discovered by the torsion balance, not the seismograph, and was condemned by the latter.

No. B17 Boggy Creek was discovered by geological work and core drilling, not geophysical work.

No. C37 Bayou Henry was the temporarily successful attempt to attract and hold the attention of rival scouts to an area when there was nothing of interest. It was soon checked and condemned by all companies.

No. C46 is a torsion balance prospect.

Page 36: The maxima over many salt domes is due not only to the effects of the cap rock but also to the upper part of the salt. On some of the shallowest domes, the top of the salt is 0.2 to 0.3 heavier than the surrounding sediments.

"The coastal effect and the effect of the pre-Tertiary land surface" should not be stated so dogmatically. The reviewer doubts them very much. If present, they are extremely small. It is much more probably a question of the conformation of the salt series in depth.

Page 37: The question of maximum versus minimum in connection with the salt domes and oil fields seems to the reviewer very plainly to be the effect of differences in form, depth, and shape of the salt core (and in the shallower domes, of the cap rock).

Page 43: Typographical errors, Northam - Wortham, and Leguin - Seguin.

The excellent work with the torsion balance on the Mexican salt domes is not mentioned. The legends of figures 19 and 20 are interchanged.

Page 60: Reconnaissance prospecting for salt domes in the Gulf Coast is and has been done extensively with the torsion balance. At the present about half of the torsion balances of this country are in the Gulf Coast, mostly on reconnaissance for salt domes.

Pages 59 to 72: A somewhat more optimistic impression of the success of the magnetometer will probably be obtained from these pages than perhaps is warranted.

Page 82: The extensive series of measurements by the American Petroleum Institute fellows, unpublished as yet, but generally known to the oil fraternity, has been overlooked.

Page 85: The suggestion that a supersensitive seismograph with large amplification will allow a considerable reduction in the amount of dynamite does not work out in practice, as a micro-ground unrest puts a very definite limit to sensitivity and amplification.

Pages 92 to 93: The same comments about Gulf Sulphur, Big Hill Matagorda, Raccoon Bend, and Davis Hill hold as before.

Page 94: The same comments hold as for the same list on position, page 32. It is a very uncritical listing of supposed discoveries.

Page 96: The Geophysical Research Corporation was started in 1925.

Page 128: The depths reached by the torsion balance and seismograph are much understated. It is size versus depth which counts with the torsion balance. In many places the torsion balance seems to be mapping batholiths in the basement whose relief may be several miles and the surface of the basement itself may be at a depth of 10,000 feet. Salt domes which do not rise to within 4,000 feet of the surface probably can be mapped; at least we think we are mapping salt domes which may not rise within 6,000 feet of the surface. The seismograph companies think that they are working well below 5,000 feet. (15,000 feet in California; 12,000 feet in southeastern Texas).

The faults and lacks of this paper largely arise from the facts that its scope is so enormously broad and that it apparently was rather hastily written. It falls just short of being a most excellent paper. The reviewer recommends it to any one who wishes to get a vivid picture of the magnitude and extent of geophysical prospecting. -- Donald C. Barton.

APPLIED GEOPHYSICS IN THE SEARCH FOR MINERALS

By A. S. Eve and F. A. Keys

Cambridge University Press, 1929, 253 pp., 92 figs.

This book is recommended as an easily readable textbook for elementary classes in geophysics and as an interesting and readable account of geophysical prospecting for the layman. The geophysicist specializing in one or two methods will find much of interest in it. Although elementary, it has considerable depth. It describes the instruments and methods of the magnetic, electromagnetic, electric, and seismic methods in relatively simple terms, in pleasingly readable English, and with restraint against too much superfluous detail and too much highbrow conciseness. Not all parts of the discussions of the mathematical theory will be followed by the average engineer or student without assistance. Many of the comments on the seismic method are considerably out of date. The connection of micropaleotology and diamond drilling with geophysics seems rather slight and not so close as the unmentioned petrography. -- Donald C. Barton.

THE HISTORY OF MAGNETIC AND ELECTRICAL PROSPECTING FOR ORE

By Hans Lundberg

The Mining Magazine (London), vol. 41, No. a, August, 1929, pp. 73-78.

Magnetic prospecting for iron ores was first used in Sweden early in the seventeenth century. The miner's dip needle compass was introduced toward the end of the eighteenth century. A great improvement came in the middle of the nineteenth century with Thalen's work on the theory of magnetic prospecting and Thalen and Tiberg's inventions of their magnetometer and inclinator. Magnetic prospecting was first used in America, and was successful in New Jersey and New York. Subsequently magnetic prospecting was used extensively in the . Lake Superior district.

The natural earth electric currents in ore deposits were first detected by Robert Fox in 1830 in England. These currents were investigated in 1844 by Reich in Germany and by Barus in Nevada in 1880. Attempts to use galvanic current in prospecting were made in the 1860's. Williams, an Englishman, and Daft, an American, did much experimentation with the use of alternating current toward the end of the nineteenth century. The first discovery of ore by electric prospecting was made by Muenster of Norway in 1907. Schlumberger in 1912-13 developed his natural earth current method. The Daft and Williams method was tried out in Sweden in 1907 and in 1912. Bergstrom in 1913 introduced the equipotential method. A more powerful method using linear electrodes was perfected by Lundberg and Nathorst in 1918. The electromagnetic method was first suggested by Trustedt of Finland in 1904 and first experimented with by Lowy and Leimbach in Germany in 1910-1911. The first important experimental work was done by Conklin of America in 1917. The first discovery of ore in America with electrical methods was made by Swedish engineers in 1924. -- Donald C. Barton.

GEOPHYSICAL NOTES

The Mining Magazine, vol. 40, No. 2, August, 1929, p. 68.

The Imperial Geophysical Experimental Survey under the direction of A. Broughton Edge has been making an extensive field investigation of geophysical methods in Australia. Gravimetric surveys of the Victoria brown coal field and of the Lakes Entrance oil district. Electrical surveys have been made in several mining districts. Seismic prospecting is being carried out in the Gulgong gold district. -- Donald C. Barton.

EARLY GEOPHYSICAL PROSPECTING

By William R. Jones

The Mining Magazine, vol. 40, No. 6, June, 1929, pp. 348-351
(conclusion); see also Geophysical Abstracts 4.

Before 1861 Mallet had made an extensive study of the speed of transmission of elastic earth waves through different formations both by field experimentation with artificial explosions and laboratory determinations of the compressibility and modulus of elasticity of different rocks. His study included that of anisotropism. Milne at the end of the century modified some of Mallet's deductions and as far back as 1885 experimented with elastic earth waves produced by falling bodies. The magnetic determinations of Lloyd, Sabine, and Ross in Ireland in 1834-1835 contributed much to the foundation of our knowledge of terrestrial magnetism. Fox in 1835 invented a dip needle which was used for geophysical prospecting. Rücker and Thorpe somewhat later, Field and Harker in 1918, and Strahan and Cox in 1918 connected magnetic anomalies and geologic structure. Fox was the father of geoelectric prospecting; but Walker in 1862, Lamb in 1833, Hughes and Rücker in 1879, made important contributions, and the present application of geoelectric prospecting is to a considerable extent a modification of Daft and William's method of 1902. -- Donald C. Barton.

EAST TEXAS GETTING GEOPHYSICAL PLAY

By R. Van A. Mills

The Oil and Gas Journal, vol. 27, No. 45, March 28, 1929,
pp. 36 and 84.

This is a brief, journalistic, somewhat disconnected account of the impressions gained by discussions with various geologists and geophysicists at the Fort Worth meeting of the American Association of Petroleum Geologists in March, 1929. -- Donald C. Barton.

"WATER DIVINING"

By J. W. Gregory

British Waterworks Association Congress, 1927, 22 pp.

This paper contains an interesting, critical, somewhat historical résumé of the use of the wigglestick for the location of water. The cases which are given by Banett and Besterman (1926) and by Mager (1920) as especially convincing for water divining, independent tests of water divining in South Australia, New South Wales, Victoria, England, West Africa, and an interesting test by the Anglo-Persian Oil Co. of oil-divining of the presence of tins of oil buried within 12 inches of the surface are briefly described and critically reviewed. Professor Gregory concludes that the survival of the use of the divining rod in the search for water after the abandonment of it for its many other uses (for hunting witches, murderers, etc.) is due to the presence of shallow supplies of water abundantly but irregularly scattered, the quickness of some observers in detecting faint surface clues to their position, and to the fact that the success apparently scored in many areas is due to the wide distribution of ground water and the failure to drill in the localities condemned by the wigglestick. The movement of the wigglestick is attributed to usually unconscious muscular movements of the wigglestick operator. -- D. C. Barton.

GEOPHYSICAL SURVEYS IN VENEZUELA

By G. Jeffrys

O'Shaughnessey's South American Oil Reports, vol. 4, No. 2,
June, 1929, pp. 6-8.

A brief statement is given in regard to the rather extensive amount of geophysical work which is being done in Venezuela, together with interesting pictures of a seismic troop at work, a sketch map showing the areas being surveyed geophysically and areas which are suitable for survey, and a table showing the companies doing the geophysical work, the number of instruments, and the area in which the work is being done. There are apparently about 10 two-instrument torsion balance parties, some five or more magnetometers, and four seismic troops being used in Venezuela. -- Donald C. Barton.

GEOPHYSICS REVEAL VAST PETROLEUM DEPOSITS IN COAST REGION

By Jack Logan

Oil Weekly, vol. 51, No. 9, Nov. 16, 1928, pp. 40-50.

According to the author, during a period of a little over four years since the beginning of practical use of the torsion balance and seismic instruments, 54 domes have been found with those instruments in the coastal country of Texas and Louisiana--22 in Texas and 32 in Louisiana. Only 41 domes were discovered in the Gulf Coast and without the aid of geophysics during a period of about 25 years.

All of these 54 new domes are shown in the accompanying maps; in the accompanying tables the data are arranged in alphabetical order of the countries in which they are located.

The author remembers that, of course, it does not follow necessarily that all salt domes yield oil production.

According to rough estimate of cost expended in finding the first 30 domes by geophysical methods, the total was around $15,000,000. This is an average cost of $500,000 for each dome found.

During the five years from the discovery of the Hager-Martin Dome in Louisiana, to the discovery of Big Creek in 1928, approximately 675 wildcat tests were drilled in the Gulf Coast area in search of new domes. The cost of drilling those 675 wildcats has been estimated at $20,000,000 exclusive of the cost of leases and overhead expenses. Twenty million dollars for finding one dome which is now producing 2,200 barrels per day. That is the record for the old methods, as compared with the above-mentioned record for geophysical prospecting of $15,000,000 for finding 30 domes, including eight which are now producing about 9,000 barrels.

All the discoveries were made by using torsion balance and seismograph.

As an indication of the importance which geophysical prospecting has assumed in the Gulf Coast region, Logan points out in the last part of his article its relation to the present field of activity. -- W. Ayvazoglou.

LES MÉTHODES GÉOPHYSIQUES POUR L'ÉTUDE DES COUCHES SUPERFICIELLES DU SOL

(GEOPHYSICAL METHODS FOR STUDYING SUPERFICIAL DEPOSITS)

By Ch. Maurain

La revue pétrolifière, Nos. 322 and 323, May 25 and June 1, 1929, pp. 705-708, 745-749.

Geophysical methods of prospecting are summed up in the article. Maurain concludes that these methods are a valuable contribution to geology in studying the layers of the earth's crust from the scientific as well as practical viewpoints.

With the improvement of the instruments and theoretical progress of the methods, the value of geophysical prospecting will increase constantly.

The author notices that the problem of geophysical prospecting is often simple and can be used with great advantage--for example, for determining the extent of deposits of which one part is already known. Gravimetric and magnetic methods are especially recommended in this case. The problem may often be solved indirectly also, especially for discovery of oil, as geological formations which usually accompany the oil deposits (salt domes) may be established by geophysical methods of prospecting.

A large number of articles on geophysical prospecting is mentioned. -- W. Ayvazoglou.

GEOPHYSICAL INVESTIGATION OF BAUXITES IN JUGOSLAVIA

(In Serbian)

By Vsevolod Gorsky

Rudarski i Topionicki Vesnik (Bulletin of Mining and Metallurgical Industry), Belgrade, No. 8, August, 1929, pp. 350-358.

The author examines the question of whether geophysical methods of prospecting can be used for the discovery of bauxites in Jugoslavia, especially in Dalmatia.

Based on indirect conclusions, drawn from the consideration of chemical composition and general physical properties of bauxites and the rocks with which they are found (mainly limestones), the author is of the opinion that in some cases the magnetic and electric methods of geophysical prospecting may be used.

The problem can, of course, be definitely solved only after detailed experiments in geologically well-known bauxite deposit regions are made. These experiments will probably soon be started by the Institute of Mining Survey and Geodesy at the University of Ljublana.

A bibliography is added to the article. — Author's abstract.

QUEENSLAND GEOPHYSICAL SURVEY, LIMITED, BRISBANE

Petroleum, vol. 25, No. 10, March, 1929, p. 337.

The first geophysical survey company has been established in Australia under this name, with a capital of 100,000 pounds. Its main office is in the Courier Building, Brisbane, Queensland. The foundation resulted from the contract negotiations between a number of Australian Oil Concerns with the German Elböf Prospecting Co. in Cassel and the firm of Piepmeyer and Co.

According to the contract the German firms provided the Queensland Company with experts, as well as with necessary instruments for accomplishing the combined geoelectric, magnetic, gravimetric, seismic, radioactive, and geothermal investigations. The first party, consisting of four geophysical experts and two technical assistants, has already started its work in the Roma oil fields in Queensland. A similar second party has departed from Hamburg already in the beginning of this year. The term of contract is two years.

An Elbof Prospecting Co. party has been working also since 1927 in New Zealand. The party is equipped with all the modern instruments for geophysical methods of prospecting.

In New Zealand and especially in Australia, in which countries more than 200 oil-concession companies were formed during the last two years, the modern geophysical methods of prospecting have aroused great interest. -- W. Ayvazoglou.

8. Geology

DIE GEWINNUNG VON ERDÖL MIT BESONDERER BERÜCKSICHTIGUNG DER BERGMÄNNISCHEN GEWINNUNG

(THE WINNING OF OIL WITH SPECIAL REFERENCE TO THE WINNING BY MINING)

By Gottfried Schneiders

Julius Springer, Berlin, 1927, 356 pp., 295 figs. Price 32 marks.

Only a rather small fraction of the oil contained in the ground is to-day being recovered by drilling. Depending on local conditions, the pore volume of the ore bearer, and the viscosity of the oil, this fraction as an average can be taken to be between 15 and 25 per cent of the total oil content of the deposit. The recovery by drilling alone, therefore, is at least as wasteful as that which formerly took place in mining of ore deposits by taking out only the high-grade ores. Besides poorly cemented water horizons or breaks in such cements or in the casing left in the ground may allow water to enter the deposit, so that its remaining oil content will be lost forever.

Various estimates of the oil resources of the world have been made and, although none of these estimates could be really accurate, they showed that with our steadily increasing demand, within a measurable space of time our recovery of oil by drilling will be at an end. Then we will have to return to our old oil fields and recover the remaining, and by this the major, part of their oil by mining.

Shortage of oil has not yet been felt in this country. But in Europe, where the smaller deposits could not meet the demand, especially with the high import duties on crude and refined oil (for the protection of local industries), extremely higher prices and better market conditions have resulted, and mining of oil has become profitable. Besides, the markedly lower wages allow undertakings in Europe which present conditions in the United States render fundamentally impossible.[3]

The author of the above-named book probably has had more practical experience in the mining of oil than any other person. A mining engineer by education, he was put in charge of mining operations at Pechelbronn, Alsace, during the world war and under his supervision several shafts, 500, 590, and 720 feet deep, were sunk and underground mining started before the war was over and Alsave surrendered to France. Mr. Schneiders then supervised the sinking of a shaft of about 985 feet in the oil field of Wietze, Hannover, Germany, where the "Deutsche Erdöl A. G." began mining operations in a known field on the edge of a salt dome. These operations have turned out to be very profitable. Then in the employment of the "Deutsche Petroleum A. G.," Mr. Schneiders sank a shaft of about 260 feet at Heide, Holstein, Germany, where a large block of white chalk highly impregnated with heavy oil was to be mined, and has been in charge of mining operations at Heide for several years. Later several trips brought Mr. Schneiders to Austria, Japan, India, etc., where such mining operations were also to be started under his supervision.

The results of these years of practical experience have been noted in the Schneider's book, which is now the most complete textbook, on the mining of oil deposits. Besides, it is a purely practical book, written for the practical man in the field, with numerous technical advices for actual operations. Reference to the literature is given wherever necessary, but the former literature on this subject is very poor. No attempt is made to discuss the mining of oil shales, as the author is of the opinion that mining of oil deposits is much more profitable than the oil-shale industry. This is due especially to the greater amount of oil left in even exhausted oil fields.

Starting with a brief geological introduction on the occurrence and methods of searching for oil, first the methods of its recovery by means of the drill are discussed. Some details on the machinery used and drilling methods are given and discussed and the methods of recovery of oil through drill holes briefly outlined.

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[3] Attention may be drawn here to the mining of oil at Jacksboro, Tex., (Oil and Gas Jour., Oct. 7, 1926) and to the article by Ed. Bloesch, Bull. Am. Assoc. Petrol. Geol. April, 1926, p. 405.

The main subject of the book then follows--the winning of oil by mining. This section goes very much into detail. As the result of practical experience and theoretical investigations it is shown that only a small fraction of the oil is recovered by drilling and the importance of oil mining in the future is pointed out. Besides, drilling is always a rather risky procedure for a drill hole may or may not strike the pay horizon and even when doing so may find it dry or the oil replaced by water. Mining in fields that are well known from former drilling operations, on the other, hand, is relatively safe, for the amount of oil left in the deposit and recoverable by mining can be computed fairly accurately, and actual estimates of expenses and profits can be made in advance. Recovery of oil by mining, therefore, will put the oil industry on a sound commercial base.

After a brief historical introduction, the methods of sinking a shaft in an oil field are discussed in detail. Various forms of such shafts are given, as well as the requirements for the future operations, the machinery to be used, and the precautions to be taken. A special chapter deals with the interior fixings of the shaft with results of experience.

After the shaft has been sunk, tunnels and galleries have to be run to win the oil and to start mining. The recovery takes place in two stages: first, recovery of oil seeping into the galleries; and second, mining the oil-bearer with its oil. The amount of seep will depend on the pore volume of the oil-bearer and on the viscosity of the oil itself, for which certain estimates and computations can be made in advance. The amount of seep can also be artificially increased,--for example, by means of short drill holes,--but even without doing this, recovery can reach a considerable figure under favorable conditions. Practical experience in Pechelbronn, Alsace, has shown that ordinary drilling operations allowed the recovery of a total of 21.8 per cent of the oil contained in the sandy deposits, seeping into galleries gave additional 52.1 per cent, and mining operations supplied the remaining 26.1 per cent. These figures naturally hold only for this local case and will vary from deposit to deposit.

At Heide, Holstein, for example, the pores of the oil-bearer were so small and the viscosity of the oil so high that hardly any recovery could be received through ordinary drilling and from seeps, and nearly all of the oil had to be recovered by mining the deposit. It may be added that the flow of oil to the bottom of a well is fundamentally the same as the seeping into the galleries. Realizing how much greater the surface of a gallery is as compared with that of a vertical drill hole, it will be understood how much more efficient the seeping into galleries will be.

Gas is an important factor in oil mines. Even though the major part has been taken out of the deposit by former wells, a considerable amount of gas may still remain and by its highly explosive quality and trait of accumulating unexpectedly constitute a continuous danger for underground operations. However, when the necessary precautions are taken, mining of oil is not more dangerous than mining of coals with the danger of fire damp. The danger is greatly reduced when the gas is removed in advance by means of short holes drilled underground ahead of the workings. Then the gas recovered can even be utilized. Another still more dangerous gas is that originating from evaporation of the oil. Every such evaporation, therefore, should be suppressed as far as possible.

A special chapter is devoted to the interior arrangement of the galleries and tunnels. Whereas the oil deposits frequently have been found rather loose, the walls will not stand by themselves and have to be supported. The material has to be fireproof, and no wood should be employed for this purpose (as far as possible no burnable material should be used in any oil mine). The different types of fixings are described in detail and it is shown which type is most suitable under the different conditions. Advantages and disadvantages of all types are discussed and approximate costs given based on European conditions.

Several methods can be used for the mining of the deposit. Where applicable, hydraulic mining seems to be best and most economic method, to be used in a similar way as the underground hydraulic mining of placers in California. Another method uses dredges, etc. Manual labor should be excluded as far as possible, not only to cut expenses but also to have as few men as feasible work in these dangerous surroundings.

Then the products mined have to be hauled. No fire nor even electric engines should be used. Compressed-air engines seem to be best in many respects. Every possibility of creating sparks by electric discontinuation, by hitting hard rocks, especially flint, etc., with picks and shovels, or by the striking of horseshoes on iron rails or ties should be avoided, as fire or even explosions may be started in such ways.

The most important factor in oil mines is the ventilation. On its reliability the safety of the mine depends to a large extent. Continuous observation of the air, therefore, is absolutely vital, but if such observation is made in the proper way, then the dangers are greatly reduced. The fact that Pechelbronn and other oil mines have not had greater disasters than certain coal mines shows what strict attention to overcoming hazards can do. Means of ventilation are discussed, and formulas and figures for the amount of fresh air needed and power required are given. A special chapter is added discussing the possible causes of fires, their isolation, and prevention. Also means of rescue in case of disaster are discussed.

The treatment of the product mined, that is, the separation of the oil from the oil-bearer, can be carried out by several methods. For oil sands, washing with warm water with a large excess of water seems to be best and most economic.

The economy of oil mining is briefly discussed, and it is shown that (varying slightly with local conditions) in Germany oil contents exceeding 14.2 to 16.4 volume per cent of oil in the deposit already will yield profits. This is far below the amount of oil usually remaining in exhausted fields. A detailed subject index finally facilitates the use of the book.

This publication is interesting not only for the oil man but also for mining engineers, especially those dealing with mining of coals. Unfortunately it contains a great number of technical expressions which will make it difficult to read for those not especially familiar with technical German. Many of these expressions, however, have been briefly explained, and their use could not very well be avoided in a technical book.

The machinery referred to and shown in the numerous pictures, with few exceptions, is of German origin and manufactured in Germany. It might be suggested that in a new edition and especially in case the book should be translated, reference also should be made to machineries manufactured in other countries, especially in the United States. At any rate the book is a most welcome contribution to the oil industry. Even if the recovery of oil by mining at present does not look profitable to operators in this country they should follow the development, for the time will come when here also such operations will have to be started. -- E. U. von Buelow.